

Lethal Factors of Diseases and Protective Countermeasures of Wild and Penned Giant Pandas

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Abstract. Statistical analysis of certain major diseases lethal to the animal was carried out through on-spot investigations and consultations to related documentary materials. The results show that the first serious lethal factor is digestive system diseases. Next comes malnutrition and organic exhaustion. In order of decremental percentages, other diseases are roundworm disease, epilepsy, toxicosis, pneumonia, tumor, pericarditis, etc.. In relation to 54 wild giant pandas taken for statistics, the death of malnutrition, organic exhaustion caused accounts for 42.78%. In order of reducing percentages, other diseases are roundworm disease, toxicosis, epilepsy, etc.. Based on the statistics of 22 penned giant pandas, the death out of the digestive system diseases comes first, accounting for 63.64%. Other diseases in order of decremental proportion are epilepsy, organic exhaustion, etc.. Gastroenteric hemorrhage is one of the highest mortality in digestive system diseases, the next comes orderly roundworm disease, hemorrhage, gastroenteritis and intestinal obstruction. The mortality of the sub-adults is the highest, accounting for 64.29%, or 2.6 times as that of the adults, or 7 times as that of the aged giant pandas. Some prevention measures of diseases for Giant pandas were also discussed in this paper.

Key words: Giant pandas, Disease, Lethal factors

Introduction

It has been well known that giant panda (*Ailuropoda melanoleuca*) is an endangered and rare species that distributes in China only, whose population is diminishing. Giant panda has attracted the attentions of scientists from different walks in the world. In order to rescue the precious species, China and the world have put great energy in such contribution. Studies from various disciplines have also been conducted.

On the reasons of the endangering and mortality of giant pandas, different scientists from different disciplines have different view points. Zhu Jing et al. (1983) reported the ecological reasons causing giant panda endangered. After the postmortem examination of 33 wild giant pandas, Feng Wenhe et al. (1991) found that the roundworm infection rate of wild Giant pandas is 100%, and direct and indirect mortality rate caused by roundworm infection hits 66.67%. Ye Zhiyong et al. (1991) studied the diseases and their prevention and treatment of 55 wild giant pandas, and divided the diseases of wild giant pandas into 8 sorts, among which roundworm diseases, digestive system diseases, inspirit system diseases and starvation & exhaustion have the largest possibility. They are the main problems harming giant pandas. All the diseases reported above by these scientists threatened the population of giant pandas greatly.

This paper reports the investigation of diseases and lethal factors of wild and penned giant pandas from nutritional and feeding points. Based on the statistical canalization of the materials, the nutritional lethal factors were argued. The writer pointed that feeding with fresh bamboo powder combined feed is a reasonable way of reducing the diseases, mortality and developing population of giant pandas.

Materials and Methods

Totally 70 dead giant pandas were taken for statistics, a part of which were spot tested in Sichuan and Fujian, and the other part were from published reports.

According to the delimiting principles of growing phases of giant pandas in every breeding bases and Zhu Jing's delimiting methods of age structure, and considering the slow attacking process and long course of diseases, the authors prolong the sub-adult phase practically so that the samples can be more representative.

The delimitation of age phases in this study are shown as follow: Infancy phase: birth to weaning; Sub-adult phase: weaning to sex maturation; Adult phase: sex maturation to 20-year-old; Old phase: older than 21-year-old (21 included). Based on the delimitation, dead giant pandas taken for the statistics were sorted and the percentage of mortality of

each disease in each age group were calculated.

Results and Discussion

Mortality in Each Age Group

Of all 70 giant pandas, despite living in wild or being penned, the mortality of sub-adults and adults is counted to be more than 90%. In wild giant pandas, the mortality of subadults is 2.6 times that of the

adults, while this parameter in penned giant pandas is higher than 1.9 (see Table 1, Fig. 1). It is clear that the mortality of subadults affects the population of giant panda greatly. So it is also clear that to strengthen the scientific research of conservation and management of subadults, adopt proper measures to reduce their mortality may be the first subject to keep the endangered species.

Table 1. Mortality of each age group of both wild and penned giant pandas

| | | Infancy | | | Sub-adult | | | Adult | | | Old | | | Total | | |
|--------|----------|---------|--------|-------|-----------|--------|-------|-------|--------|-------|------|--------|-------|-------|--------|-------|
| | | Male | Female | Total | Male | Female | Total | Male | Female | Total | Male | Female | Total | Male | Female | Total |
| Wild | Number | — | — | — | 11 | 21 | 32 | 5 | 5 | 10 | 5 | 1 | 6 | 21 | 27 | 48 |
| | Rate (%) | — | — | — | | | 66.67 | | | 20.83 | | | 12.50 | | | 100 |
| Penned | Number | 1 | 1 | 2 | 6 | 7 | 3 | 4 | 3 | 17 | — | — | — | 11 | 11 | 22 |
| | Rate(%) | | | 9.09 | | | 59.09 | | | 31.82 | | | — | | | 100 |
| Total | Number | 1 | 1 | 2 | 17 | 28 | 45 | 9 | 8 | 17 | 5 | 1 | 6 | 32 | 38 | 70 |
| | Rate (%) | | | 2.85 | | | 64.29 | | | 24.29 | | | 12.50 | | | 100 |

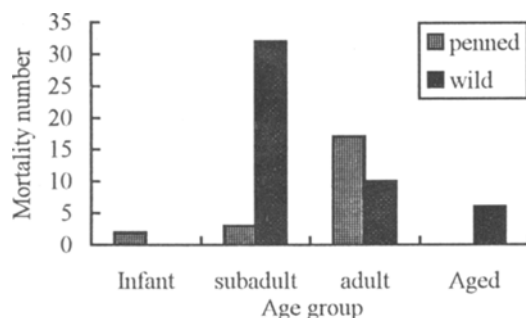


Fig. 1. Mortality number in each age group

Analysis of lethal factors and protecting countermeasures

By-effects on giant panda digestive system of bamboo coarse cellulose

Just weaning sub-adults have to lead single life and change food habits from milk full of all kinds of nutrients to wild animals and plants. Giant panda mainly feed on bamboo that highly contains rate coarse cellulose. Digestive organs and their functions of subadults haven't matured enough, and they are a little weak to digest coarse cellulose. A good amount bamboo in digestive tracts can't be digested and absorbed, and even causes intestinal obstruction. Bamboo coarse cellulose can also injure mucous membrane mechanically that leads to gastric and intestinal hemorrhage or ulcer.

There are harmful bacteria and microorganism on some bamboo. After taken by giant panda, they may cause some mortal diseases like enterogastritis, ulcer, pancreatitis, haemolysis anaemia prostration, etc..

According to the analysis, the authors consider that the main reason causing high mortality of sub-adults should be large amounts of bamboo taken in unsound digestive system. From those points, bamboo is

thought harmful and to make by-effects to the health of giant pandas.

Applying fresh bamboo powder combined feed to save giant pandas

This statistics lead us to such a consideration that if we could use the advantage of bamboo nutrients avoiding its disadvantages to giant pandas. In former studies the authors developed fresh bamboo powder combined feed. Digestive & metabolic experiment and feeding experiment of the combined feed have been conducted on migrated giant pandas. The results indicated the following advances of the fresh bamboo powder combined feed: Giant pandas have a good appetite to the feed. The bamboo power is made from all parts of bamboo, so the total amount of bamboo used is reduced. It is practical to save the bamboo resource.

The incidence of digestive system decreased by feeding fresh bamboo powder combined feed. Statistics shows that mortality is caused mostly by malnutrition and digestive system diseases in both migrated artificial bred giant pandas and those living in wild. Feeding with fresh bamboo powder combined feed can significantly reduce the incidence of these disease. In our experiments no giant panda fed with fresh bamboo powder combined feed was caught digestive system diseases like intestinal obstruction etc.. The utilization rate of the feed nutrients is heightened, and the feed cost lowered.

Respective statistics of disease lethal factors

Death reasons of wild giant panda

All 54 giant pandas mainly died of malnutrition, weakness, low immunity, nutrients deficiency and anemia or prostration caused by those. This is no doubt relative to the blooming and wither of bamboo. The second lethal factor is digestive system diseases, occupying

27.78%. The third is roundworm, 11.11%. Some giant pandas also died of food toxicosis when they took putrid bodies of animals in wild. The authors think taking putrid bodies is because of food shortage in wild, and giant pandas were in serious starvation(see Table 2, Fig. 2).

Table 2. Mortality reasons of wild giant pandas

| Lethal reasons | Number | Rate (%) |
|--------------------------|--------|----------|
| Malnutrition prostration | 23 | 42.59 |
| Digestive system disease | 15 | 27.78 |
| Roundworm infection | 6 | 11.11 |
| Poisoning | 3 | 5.56 |
| Pericarditis | 1 | 1.85 |
| Epilepsy | 2 | 3.71 |
| Pneumonia | 1 | 1.85 |
| Hepatitis | 1 | 1.85 |
| Liver cancer | 1 | 1.85 |
| Nephritis | 1 | 1.85 |
| Total | 54 | 100 |

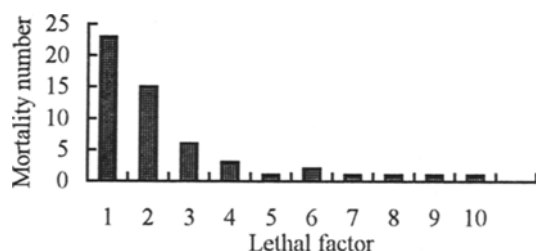


Fig. 2. Mortality number caused by different diseases

1. Prostration, 2. Digestive system diseases, 3. Roundworm, 4. Poisoning, 5. Epilepsy, 6. Pneumonia, 7. Hepatitis, 8. Liver cancer, 9. Pericarditis, 10. Nephritis

Death reasons of penned giant pandas Relatively few penned giant pandas die of malnutrition. Of all giant pandas taken for statistics, two who died of malnutrition and prostration were taken from wild when they were in serious starvation. They didn't manage to recover before they died. Under artificial breeding, the nutrients needed by giant pandas can be satisfied basically, so malnutrition and prostration seldom happen. But digestive system diseases have a very high frequency (see Table 3, Fig. 3).

Table 3. Statistics of mortal reasons of penned giant pandas

| Lethal reasons | Number | Rate (%) |
|--------------------------|--------|----------|
| Digestive system disease | 14 | 63.64 |
| Malnutrition | 2 | 9.10 |
| Epilepsy | 3 | 13.64 |
| Heart failure | 1 | 4.54 |
| Pneumonia | 1 | 4.54 |
| Tumor | 1 | 4.54 |
| Total | 22 | 100 |

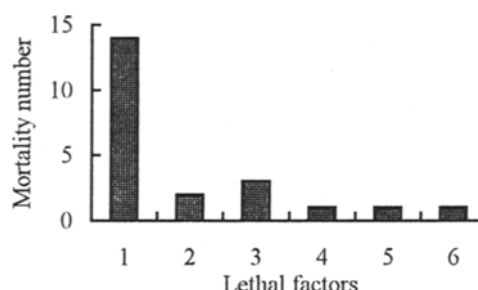


Fig. 3. Mortality number of penned giant pandas died of different diseases

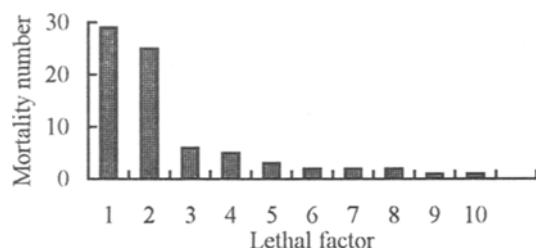
1. Digestive system disease, 2. Epilepsy, 3. Malnutrition, 4. Heart failure, 5. Pneumonia, 6. Tumor

General statistics of mortality of wild and penned giant pandas

In both wild and penned giant pandas, digestive system diseases, malnutrition and prostration are two main lethal factors. Other diseases seldom cause mortality(see Table 4, Fig. 4). The authors considered that malnutrition and prostration were caused by the blooming and wither of bamboo in giant pandas' habitat in 1980s. Digestive system diseases are closely related to bamboo as main food of giant pandas. In captured condition concentrated feed and bamboo are provided enough, so malnutrition and prostration seldom occur. Nevertheless, Digestive system diseases have a high frequency in both wild and penned giant pandas. Among 76 giant pandas investigated, the frequency of mortality of digestive system diseases hits 38.16%, marking the first among all the lethal factors. This sort of diseases are mainly because of bamboo. For penned giant pandas, the ration is mainly composed of two parts, one is concentrated feed and the other is bamboo containing very high rate of coarse cellulose. Originally, giant panda lived as carnivores, mainly feeding on animals that can be easily digested. Up to now, the digestive organs and enzymes are still keeping the features of carnivores, such as short digestive tract, no cecum, short retention of food in digestive tract and lack of digestive enzymes, bacteria and microorganism that can digest coarse cellulose. Thus, it's difficult for giant panda to digest bamboo, especially the coarse cellulose. In order to meet the demand of all kinds of nutrients, however, giant pandas have to take a large amount of bamboo, which is the very cause harmful to the digestive tract. It was often found that mucosa of stomach and intestine were injured by bamboo joints, so diarrhea and enterogastitis were touched off. This is particularly serious in sub-adults whose digestive system hasn't fully developed yet.

Table 4. Statistics of mortality reasons of 76 dead giant pandas

| Lethal reasons | Number | Rate(%) |
|---------------------------|--------|---------|
| Digestive system disease | 29 | 38.18 |
| Malnutrition, Prostration | 25 | 32.89 |
| Roundworm | 6 | 7.90 |
| Epilepsy | 5 | 6.57 |
| Poison | 3 | 3.95 |
| Heart failure | 2 | 2.63 |
| Pneumonia | 2 | 2.63 |
| Tumor | 2 | 2.63 |
| Nephritis | 1 | 1.32 |
| Hepatitis | 1 | 1.32 |

**Fig. 4 Comparison of mortality reasons of 76 dead giant pandas**

1. Digestive system diseases, 2. Prostration, 3. Roundworm, 4. Epilepsy, 5. Poison, 6. Heart failure, 7. Pneumonia, 8. Tumor, 9. Nephritis, 10. Hepatitis

The following digestive system diseases come on in very high frequency: enterogastritis, gastroenter-rhagia, volvulus, intussusception, hemolytic anemia, pancreatitis and ascariasis etc.. Roundworm is a kind of parasite that comes on when giant panda takes bamboo with roundworm eggs. The infection rate reaches 100% in giant pandas living in wild. A few penned giant pandas can also be infected. An individual was found to have the most, 2304 roundworms (Ye Zhiyong, 1981). Roundworms absorb nutrients from digestive tract, which leads to malnutrition, emaciation, asthenia, low immunocompetence and some other diseases relative to that. Roundworm also enter biliary ducts, ducts pancreaticus etc., directly harm the life. It was reported that hemolysis always happens after enteritis caused by coli-infection, because the hemolytic streptococcus enter intestine wall and initiate hemolytic diseases and pancreatitis. After a long course of suffer, giant panda dies of hemolytic anemia and exhaustion. So the authors sort the hemolytic diseases as digestive system diseases. Table 5 shows the lethal digestive system diseases.

Among the 32 giant pandas investigated, gastroenter-rhagia is the first lethal diseases, the seconds are hemolysis, ascariasis and enterogastritis in order. Among all kinds of digestive system diseases, the

key pathogenic factor should be high content of coarse cellulose of bamboo.

Table 5. Statistics of giant pandas die of each kind of digestive system diseases

| Lethal reasons | Number | Rate(%) |
|-------------------|--------|---------|
| Gastroenteritis | 5 | 15.63 |
| Gastroenterrhagia | 7 | 21.87 |
| Ileus | 4 | 12.50 |
| Ascariasis | 6 | 18.75 |
| Hemolysis | 6 | 9.37 |
| Pancreatitis | 3 | 3.13 |
| Volvulus | 1 | 100 |
| Tota | 32 | |

Conclusion

Disease is one of the factors causing giant pandas population decreasing. For those living in wild, mal-nutrition and prostration are the two main lethal reasons, occupying more than 42% of the total death. the second lethal reason is digestive system diseases, occupying more than 27% of the total.

For penned giant pandas, they were fed on artificial concentrated feed, in which all nutrients needed are provided. So they seldom suffer from malnutrition. But they still keep a high mortality. The main problem is thought to be digestive system diseases. gastroenter-rhagia, enterogastritis, ascariasis and hemolysis cause much mortality, occupying 63.64% of the total.

Among mortal giant pandas, sub-adults whose digestive organs and digestive functions are not developed well enough take the role of 64.29% of all death. It becomes so clear that the advance research and management measures should be adopted to avoid and reduce the mortality of this part.

Based on the feeding experiments, the development and application and dissemination of fresh bamboo powder combined feed to the raising of penned and wild giant pandas is one of the central countermeasures to reduce their deficient nutritional and digestive system diseases. Some relative departments should spend more investment on the development and application of fresh bamboo powder combined feed, and more power on pushing the development of the new type of feed series to an earlier practice.

References

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